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*On some points connected with the Education of an Actuary. By  
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Assurance Office.*

[Read before the Institute, 28 November, 1853, and ordered by the Council  
to be printed.]

IN the paper I shall have the honour of reading to you this evening, upon some points connected with the education of an actuary, I shall endeavour to describe some of the more important duties and responsibilities of that office—to offer some observations to the student, as to his preparation for the profession of an actuary—and to suggest to the Council of the Institute some reasons for enlarging the sphere of the examinations that they may think proper to prescribe.

I shall not detain you with any account of the ordinary duties of an actuary, which are of course well understood in this room, but shall at once proceed to the consideration of the foundation of all actuarial knowledge—mathematics.

I believe it is now generally considered, that a very abstruse mathematical knowledge is not absolutely requisite for the general business of an actuary. I am not, however, prepared to coincide in the opinion of those who say that it is rather detrimental than otherwise, as we know of many instances which prove that the highest scientific knowledge and perfect business habits are not necessarily incompatible; but we also as certainly know that the prosperity of some Companies has been sacrificed to the closet meditation of the profound theorist—although it is right to add, that the success of others is mainly to be attributed to the sound principles which the master mind of the mathematician inculcated in their earlier stages, and the departure from which in their later career he knew would not be unattended with danger.

In the infancy of Life Assurance Associations, the directors, wisely acting upon the advice of the scientific man, were content to follow his recommendations; but modern experience shows that these gentlemen, though generally unacquainted with the theory of the business, are not at the present time so ready to bow to the dictum of their actuary; and one instance in particular may be adduced in support of this statement—when, on a recent occasion, a board of directors not only acted perfectly in opposition to the most proper advice of their actuary, but also ridiculed the prominence, phrenologically speaking, of his organ of caution.

Mr. Babbage, in his work on assurance, published in 1826, speaking of actuaries, says that “the degree of knowledge possessed

by persons so situated at the different institutions is exceedingly various, passing through all degrees, from the most superficial acquirements, derived merely from the routine of an office, up to the most profound knowledge of the subject." If this were true in 1826, how much more so it must be at the present time it is painful to contemplate.

An acquaintance, however, with the highest mathematics, is probably not essentially necessary for an actuary. It is quite true that in the determination of the law of mortality, and in the adjustment of mortality tables, high mathematics come into play with advantage, and cannot therefore be too sedulously cultivated; but such a knowledge of algebra as will enable a student to solve any question in arithmetical and geometrical progression, the summation of series, the theory of differences, and the less complicated cases in the theory of probabilities and the doctrine of chances (which necessitates of course a thorough knowledge of all the more elementary parts of algebra, upon which each and every one of these subjects depend), may, I consider, be deemed a good foundation on which to commence the study of the theory of annuities and assurances. Upon the necessity of a perfect knowledge and understanding of these and of all cognate subjects, I need not of course dwell; this is *par excellence* an actuary's business.

Let it not be supposed that I underestimate the value of mathematical knowledge. The mere study of this branch of science, apart from its direct usefulness, has the effect of promoting and improving our powers of judgment, of creating in us care and caution, and of indirectly producing those very qualities for which, I believe, actuaries are noted. Mathematics is undoubtedly the groundwork of all life assurance—at the same time the foundation upon which the superstructure is raised, and the concrete which binds together all the elements of the building; but, like that concrete, which originally is but an impalpable powder, it requires not only the application of other elements to render it useful for its intended purpose, but also the hand of the experienced artificer to direct its application.

Still, theory, however necessary to the actuary, is only one of his requirements. A perfect actuary should be a kind of "admirable Crichton."

He should, in the first place, have a good general education—such a liberal education as a university course provides. I do not mean that he should be such a proficient in the Latin and Greek languages as to be able to write a disquisition upon a disputed

reading, or a treatise upon a Greek particle, but that he should have a good useful knowledge of these languages. In these days, with the advance of science, new words are constantly being introduced into our language, and most of them from the Latin and Greek—more, perhaps, from the latter; and nothing assists the mind in the remembrance of scientific terms so much as an exact knowledge of their derivative meaning; indeed, without this, their precise signification can never be apprehended. In the science of anatomy, for example, without a perfect familiarity with the derivation of the terms in use, a student would be perfectly lost.

These remarks do not apply particularly to the business of an actuary, as generally understood; but to the cognate subjects connected with it they most assuredly do. For example: the directors of an Office observe, or seem to observe (for nothing is more fallacious than the impression sometimes conveyed to the mind by observation only, without recourse to a proper statistical inquiry), an unusual mortality from some particular disease, and request their actuary to prepare a nosological table of the causes of the deaths that have occurred in the Office. You may say, the medical officer is the proper person to make such a table. Granted: but a clever statist, with some knowledge of medical nomenclature, would be an invaluable assistant, at least, to the doctor. Now the medical certificates of the causes of death, required by the Registrar-General, invariably give the scientific name for the disease; and a man must be uncommonly well read, and must be possessed of a very tenacious memory, who, without knowing something of Latin and Greek, can interpret these (to him) cabalistic terms; but with a fair knowledge of the roots of the words, no one need be ever at a loss.

I could multiply examples showing the advantage of this kind of knowledge; but I am desirous of confining myself to the main object of this paper, the education of the actuary, and therefore shall say nothing on the subject of the gratification to be derived from classical reading, or of the solid advantages of a classical education—no unimportant sequence of which is what has been called the *γῆρασκειν διδασκομενος*, or the desire of learning as we advance in years, and which Urquhart, in his *Commentaries on Classical Learning*, says “is the ardent wish of every mind which has been improved by early culture, and is actuated by laudable emulation.” Further, a knowledge of the dead languages undoubtedly facilitates the acquirement of the living; and Assurance Companies are now extending their operations so much on the Conti-

ment, that an acquaintance with the French language, at least, is becoming daily more desirable, independently of its being a necessary part of the education of a gentleman.

To be enabled to advise his board upon the acceptance or rejection of doubtful cases, where the reasons for and against the acceptance of a life proposed for assurance are nicely balanced, or to determine the additional premium that should be required in a special case, an actuary should not be totally ignorant of the causes and effects of diseases; in fact, every man, of whatever profession, should have some knowledge of the physiology of the human frame. The opinion of the actuary often has, and very properly so, great weight with the directors; and the more, therefore, he knows of these subjects, the better.

Knowledge of this nature is particularly brought to bear in cases in which the calling of the life proposed is not of a very healthy nature, and particularly when this is the case in a life otherwise not perfectly unexceptionable; and affords the means of determining how far certain circumstances, in connection with others, may affect a life prejudicially. The effects of certain avocations upon different constitutions are well worthy of the study of the actuary. Some classes of workmen, as is well known, are liable to particular kinds of diseases, and are totally exempt from others; and it does not always happen that the popular ideas on these points are the true ones, as deduced from actual statistical inquiry. I would here mention a work by Mr. Thackrah, *On the Effects of Arts, Trades, and Professions on Health and Longevity*, published as long ago as 1832, but I believe little known to the profession. I am not aware of the existence of any other English book on this subject; but if Dr. Farr (who, I am given to understand, has in his possession ample materials for a work of this nature) could be induced to give us the benefit of his labours, such a work, from a man of Dr. Farr's reputation, not only as skilled in medicine, but as a statist, and, what is more, as an actuary (though not a professional one), would be a most valuable contribution to the library of an Assurance Office.

The mention of this gentleman's name brings me naturally to the subject of statistics, as to which Dr. Farr is an acknowledged authority. I will here venture to remark, that had this gentleman devoted himself to the business of life assurance, he would have been my *beau ideal* of an actuary, combining as he does medical knowledge with extreme statistical acumen, and the highest mathematical theory with an admirable talent in its practical application.

His writings on annuities and assurances, and the tables that accompany them, in the appendices to the Registrar-General's Reports, may be reckoned among the most valuable contributions on these subjects. I am proud that we are able to number him among the Honorary Members of this Institute.

I should wish here to observe, that as Dr. Farr is not a professional actuary, it is not invidious to select him as an illustration of my views of what an actuary should be; though it might be so considered, if I adverted to the qualifications of any other gentleman, who might equally realize my idea.

To return to statistics. This science is the very foundation on which the superstructure of life assurance is raised. To the labours of the statist we owe the compilation of the details from which the tables of mortality are formed; by his knowledge we are cautioned in respect of the acceptance or rejection of lives proposed for assurance, instructed as to the mortality we are likely to experience, and enabled to ascertain how far the mortality actually experienced exceeds or falls short of what we had been led to anticipate; and, finally, when our claims arise, we are enabled by the help of statistics to test the accuracy of our proceedings. Thus far does this science bear on the daily business of life assurance; but it has many other and far higher objects.

Leaving out of view upon the present occasion the necessity of statistical information to the legislature, with respect to education and the prevention of crime, I shall merely touch upon the subject in its relation to *our* interests—viz., as to the assistance to be derived therefrom in testing the efficacy of sanitary improvements, which, of course, greatly affect Life Assurance Companies.

At the last annual meeting of the Metropolitan Association for the Improvement of the Dwellings of the Industrious Classes, the result, as shown by Dr. Southwood Smith, so far outruns reasonable expectation as to be almost beyond belief. During the preceding five or six years, the improvement in the sanitary condition of the districts under observation had been steadily progressive up to the time of the report. The dwellings under the Association had been provided with efficient drainage and a good supply of water, while the cesspools had been removed; and the result was, that there had not been a single death from fever in any one of them since they were first opened, and that a barrier had been placed around them which this mortal pest of our towns and cities had not been able to pass, and thus the spread of contagious diseases entirely prevented.

The experience of the kindred establishment over which Lord Shaftesbury presides gives similar results, and the same may be said of the working of the Common Lodging-houses Act; in fact, in every district in which improvements of this kind have been carried out, in provincial towns as well as in the metropolis, these results have followed; and thus the direction in which our endeavours must tend, with the view to the amelioration of the condition of the lower orders, and their ultimate moral and physical redemption, is plainly indicated.

It falls within the province of the actuary to determine how far longevity may be influenced by such improvements as these, as well as by the discontinuance of intramural interment, by the establishment of baths and washhouses, and by other similar means. The change in the habits of the upper and middle classes, too, which has taken place within the last five-and-twenty years, in respect of temperance, and the custom now so general of living out of town, have no doubt tended to the extension of the term of life.

As to the legal portion of an actuary's duties, I have not much to say. I am aware of the legal aphorism, that "whoever is his own lawyer has a fool for his client"; but no one can be connected with a Life Office for any length of time without learning something, at least, of the routine of legal affairs—the more that can be learnt, of course, the better; and many gentlemen in this room must have had numerous opportunities in the course of their experience of observing how useful a clever actuary may be to the lawyer.

The model actuary, then, as a statist collects and arranges the materials for his mortality table; as a mathematician he constructs, accommodates, and corrects it, according to scientific principles; and from this source he calculates his tables of annuities and of premiums.

His knowledge of the nature of diseases, and of their effect upon certain constitutions and under different conditions, enables him to co-operate with the physician; and thus the medical knowledge of that officer is combined with the statistical element in the hands of the actuary, and the knowledge of both is thus made practically useful. His legal knowledge, if sound, may save the Company much expense—his sphere of usefulness is enlarged, and he becomes a valuable coadjutor of the legal adviser of his Company. As a scholar, the actuary is continually in request. As a man of business, his services are invaluable.

In the term 'business,' I include a knowledge of finance. In

this capacity, the actuary will have not only to advance the interests of his Company in every possible way, but it will be his duty to be ever on the watch for any change in monetary affairs which may possibly affect the future investments of the Company, or call for any alteration therein.

It will be his duty to protect his Company not only from all ordinary contingencies, but from all injurious and unjust legislative enactments. Unaided, he cannot do much in this respect; but by a zealous co-operation on the part of the whole body of actuaries, a great deal can be effected. In illustration of this, I need only refer to the valuable services of the actuaries in respect of the Income Tax, the Successions Duty, and the Friendly Societies Bills. With respect to the first, although the views of the actuaries were considered too complicated, and therefore not carried out, still there is, I believe, no reason to doubt that the evidence given by the actuaries before the Committee of the House of Commons led to the introduction of the Successions Duties Bill, that triumph of modern legislation. This Act in effect creates such a charge upon property as the actuaries have always advocated; the duties, however, being levied at uncertain periods and at varying rates, instead of at certain periods and at one unvarying rate.

The Bill, however, contained originally provisions of a character that would have been very injurious to many Assurance Companies, and particularly so to those which are in the habit of purchasing reversionary interests. The amendment of these provisions the actuaries have succeeded in procuring.

Their exertions in respect to the Friendly Societies Bill are well known; while as regards the question of assurance legislation now before Parliament, the public service they have rendered by their evidence before the Select Committee is incalculable, the result of which has been a report embodying a recommendation of some most wholesome and necessary provisions for the future regulation of Life Assurance Societies.

An actuary, moreover, should be a good accountant, inasmuch as the accounts of an Assurance Office are of a peculiar character, and sometimes involve very great niceties. He should also be a ready correspondent. He should be well read in all the literature appertaining to his profession, and should be prepared at all times to take advantage of any improvements that may enable him legitimately to extend the business of his Office, as well as to be on his guard against unsound modes of business; for though it is true that many Offices are rushing headlong into the most delusive



schemes, it is equally true that others are neglecting to take advantage of improvements of which the system of life assurance is fairly susceptible.

May I now be allowed to offer a few suggestions to those who may be preparing themselves for the profession of an actuary?

The students of the present day, it must be granted, have aids and advantages within their means which were totally inaccessible to those of some few years back. The numerous works on the subject of annuities and assurances which are now published render them in a great degree independent of their seniors in the profession; and through the medium of the Institute, a student, by hearing the various papers read and the discussions upon them, is enabled to obtain as much information in a few years as he formerly could do in a quarter of a century.

Before commencing the study of annuities and assurances, the student should have a thorough knowledge of arithmetic and of the elementary parts of algebra. Arithmetic, if properly studied, upon rational principles, is as useful an exercise of the mind as geometry or logic. I would warn the student against neglecting the study of geometry, which, apart from its usefulness (though it has no direct bearing upon life assurance mathematics, and therefore not unlikely to be neglected), is an exercise of the mind by no means inferior to that of logic, and plays no inconsiderable part in developing and strengthening the reasoning powers, and in promoting the formation of habits of application and industry.

With respect to the study of annuities and assurances, it is to be regretted that no text-book exists which, although containing less than the noted work of the late Mr. Milne, while retaining the lucid explanations of Mr. Baily, might unite in itself the practical advantages of Mr. David Jones' work and the uncompleted book of Mr. Davies: for while, on the one hand, the work of Mr. Jones does not enter into the subject of three or more lives, Mr. Milne goes too fully into that subject for the beginner; and the confusion caused by the different notations used not only by each of the above, but by every other writer on the subject, is a great obstacle in the way of the student, if not a great inconvenience even to the practised actuary. The valuable contributions of Mr. Benjamin Gompertz on this subject are almost totally inaccessible. Now a compilation from the writings of Baily, Milne, Gompertz, Davies, and Jones, with the addition of the valuable tables of the latter, would be no less useful to the actuary than valuable to the student; the notation being of course assimilated—shall we say to that of

Jones, as being perhaps the most simple, and certainly the most *universal*. I will venture to throw out the suggestion as to whether arrangements might not be made for the preparation of such a text-book, under the auspices of the Council of the Institute, upon a plan somewhat similar to that on which the *Experience of Offices* was published in 1843.

The seniors of the profession will probably agree with me, that it cannot be too strongly impressed upon the mind of the student that the mere acquaintance with mathematical formulæ is not sufficient to make an actuary. I have before stated that this is only one out of many kinds of knowledge requisite. I will now go so far as to state my belief, that even in computations where the mere theorist might be supposed to be quite at home, it is not sufficient at once to adopt the numerical result arrived at by calculation. Those who have been in the habit of seeing that class of cases which arise in the private practice of the actuary, and particularly in that of the actuaries of Reversionary Investment Companies (and which are of a far higher order than the ordinary Assurance Office calculations), must be well aware that, in many cases, *judgment*, both as to the treatment of the case and as to the adoption of results when arrived at by calculation, or the modification of those results, is no unimportant aid to the actuary; indeed, cases may and do arise in practice, the result of which, untempered by judgment, would be absurd. Judgment and experience, which cannot be taught (the one must be inherent to a certain extent, and carefully fostered; the other must be acquired), are necessary as well in an Assurance Office as in a Reversionary Investment Company: and hence arises the necessity of an apprenticeship, if I may use the expression, to the business of life assurance; and it can hardly be doubted that this is no less necessary than in other professions, in all of which a certain probation is now required.

For the Institute, then, it remains to show to the world its fitness to be entrusted by the legislature with certain powers and privileges necessary to give weight and authority to its examinations; and probably the best method to make public the advantages it offers is to afford to its members voluntarily coming forward the opportunity of undergoing a searching examination by gentlemen of undeniable attainments in the several branches of education necessary for an actuary.

It might be desirable for the Institute to take steps to inform the boards of directors of the different Offices that such examinations have been instituted—the nature and extent of the tests

employed, and the description of reading requisite to prepare candidates for undergoing the examinations—and, further, to furnish lists of those that have passed the ordeal; it will then be within the means of every board of directors to secure not only qualified actuaries, but efficient clerks of a superior calibre. The examinations now prescribed by the Institute are three in number, each more difficult than the preceding; now it would be no great hardship to require that every clerk in a Life Office, being—say, 18 years old, should within two or three years from the date of his appointment be required to pass the first examination, and the succeeding two within intervals of not more than two or three years thereafter.

I merely throw out these suggestions as a groundwork to begin upon—of course the subject should be very fully considered before any steps are taken in the matter; but I think, now that Assurance Offices are being multiplied to such an extent, that it is ridiculous to suppose that all the *employés* are competent to be advanced to positions of responsibility; and I consider that a man who takes the management of the affairs of an Assurance Company, involving the social interests of thousands, is morally most culpable if he be not fully competent to the task he undertakes: and it is difficult to understand where many who have assumed these responsibilities have acquired their experience; and even a senior wrangler, without experience of life assurance, would be helpless in a Life Office.

The Council of the Institute labour under some difficulties with respect to the examinations, and they have evinced great judgment in the plan they have hitherto pursued. Being voluntary, they must not be made too difficult, or many will be deterred from offering themselves; nor must they be too easy, or the character of the Institute will suffer: but if it be desired that the Institute should take a high standing, and prove itself worthy to be entrusted with a charter of incorporation, I submit that more subjects should be introduced into the examinations. As they are now arranged, as far as they go they are probably sufficient: but I have shown, I hope, that something more than an acquaintance with mathematics is necessary for the education of an actuary; and I should be glad to see Mr. Jellicoe's views on these points more fully carried out, by the introduction of new subjects into the examinations, and by making it indispensable that a complete course of education should be gone through before the application of the final test. If some improvements of this kind were introduced, the plan of the Institute might become not only the

foundation on which a Government test might be raised, but probably the means of its introduction.

We shall find, in course of time, that as public attention is drawn to the matter, the profession of an actuary will be more looked up to than it is at present. The next generation of actuaries will, with the assistance of the Institute, be all competent men; and in time we shall see that no one will any more think of calling himself an actuary without a proper qualification, than at present he would call himself a physician or a barrister without having complied with the necessary requirements. One great advantage likely to be derived from the Institute examinations (quite apart from the necessity for them) is the test of competition, which alone will create a superior class of men.

Mr. Macaulay, in his speech in the House of Commons on the 25th June last, on the Indian question, bore testimony to the success of the test by competition, which, he said, had been proved by the career of those who took the highest honours at Cambridge and Oxford; showing that academical triumphs were not fugitive distinctions, but that it was the general rule that those who were first in the competition of the schools, were foremost in the business of life: and the *Times*, commenting on Mr. Macaulay's speech, added, that "the child is father of the man"; and that "the ardent spirit which distinguishes itself in the camp, in the council, and in the senate, or wherever it may be demanded in the field of active life, will generally be found to have distinguished itself at school and college, whether the competition be in Latin hexameters, or in the differential calculus."

I now conclude, with the expression of a hope that I may not be thought presumptuous in thus offering my views to the Council and members, inasmuch as I am solely actuated by a desire to see the position of the Institute improved, and the profession of the actuary proportionally elevated.

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"THE whole commerce of the country turns on contingencies which demand the application of scientific observation and calculation; and, as English agriculture has its chemists, English commerce must, to keep pace with it, ultimately employ actuaries to calculate the risks which are now only roughly guessed at, and thus extend the useful sphere of an important scientific class of men, at present almost peculiar to this country."—*Letter to the Registrar-General, by William Farr, Esq. (vide 12th Annual Report).*